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**REMARKS**

1. In reply to the restriction requirement set forth in the Office Action mailed October 3, 2001 (Paper Number 3), the provisional election to Group I, claims 1-10, made by Melanie L. Brown during a telephone conversation with the Examiner on September 10, 2001, is affirmed.
2. Claims 1 and 7 have been amended to correct a lack of antecedent basis noted by the Examiner and to more specifically define the invention in accord with the specification. The step c) amendment to claims 1 and 7 finds support in the specification on page 6, lines 8-9, and page 8, lines 22-24 and 31-35. The step d) amendment to the same claims finds support in the specification on page 4, lines 13 and 26-29, and page 6, lines 10-11. The step e) amendment to claim 1 and the step f) amendment to claim 7 find support in the specification on page 6, lines 19-22. Since no new matter has been added by these amendments, it is respectfully submitted that they should be entered.
3. The Summary of the Invention has been amended to read on amended claim 1, with support therefor being found in the specification as set forth for amended claim 1. Since no new matter has been added by this amendment, it is respectfully submitted that it should be entered.
4. New dependent claims 14 to 17 have been submitted for embodiments described in the specification but not previously claimed. Support for claim 14 is found in the specification on page 6, lines 27-29. Support for claim 15 is found in the specification on page 8, lines 22-24. Claim 16 finds support on page 8, lines 33-35 of the specification, while claim 17 finds support on page 9, lines 11-13. No new matter has been entered by claims 14-17, it is respectfully submitted that they should be entered.

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5. Claims 1 and 2 stand rejected under 35 USC § 102(b) as being anticipated by Greenhalgh (US 2,510,574).

A claim is anticipated only if each and every element as set forth in the claim is found, whether expressly or inherently described, in a single prior art reference. *Verdegall Bros v. Union Oil Co. of California*, 814 F.2d 628, 631 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the... claim. *Richardson v Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)

It is submitted that claim 1, as amended, patentably distinguishes from Greenhalgh. Nowhere does Greenhalgh disclose the use of rotational agitation to shear thin a mixture. Greenhalgh describes the use of vibration to generate pressure waves (Col. 4, lines 11-16). The function of the pressure waves is to generate instability in molten metal jets and enhance drop formation (Col.3, line 1 to Col. 4, line 75). However, pressure waves are not listed as methods of agitation in Perry's Chemical Engineers Handbook, Sixth Ed., McGraw Hill, New York, P. 19-5 to 19-8, 1984 (attached). More specifically, pressure waves are not the functional equivalent of rotational agitation. Moreover, Greenhalgh describes molten metal alloys. Liquid metals, e.g., mercury, are generally Newtonian liquids, having viscosities independent of shear rate (no shear-thinning).

Greenhalgh therefore fails to teach each and every element set forth in amended claim 1, and thus claim 2 dependent therefrom. Accordingly, reconsideration of the foregoing rejection of claims 1 and 2 is respectfully requested.

6. Claims 1, 2, 5, 7 and 10 stand rejected under 35 USC § 102(b) as being anticipated by De Bruyne et al. (US 3,055,049).

It is submitted that claims 1 and 7, as amended, patentably distinguish from De Bruyne et al. De Bruyne et al. describes several embodiments of a prilling device; however, De Bruyne et al. fails to discuss either reaction of components or formation of a shear-thinnable mixture. Although De Bruyne et al. notes that prilled melts of urea, ammonium nitrate, ammonium nitrate mixed with limestone or dicalcium phosphate, calcium nitrate (Col. 1, lines 11-13) are known

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in the prior art, it fails to address whether any of these substances or mixtures has shear-thinning properties. The above substances are not formed by reaction in the prilling process.

Nowhere does De Bruyne et al. disclose the use of agitation to shear thin a mixture. De Bruyne et al. describes the use of "scraping element" on the inside of the perforated wall of a prilling cup. However, Figure 1 of De Bruyne et al. shows a scraping element having very small lateral dimensions. A scraper rotating in such a small fraction of the volume of the prilling cup will not provide significant agitation. A rotational speed of at least 200 rpm is not specified or suggested. The mechanical arrangements in Figures 2 and 3 of De Bruyne et al. are even less suited to an agitation function.

Thus, De Bruyne et al. fails to teach each and every element set forth in amended claims 1 and 7, and claims 2, 5 and 10 which directly depend either from claim 1 or claim 7. Accordingly, reconsideration of the foregoing rejection of claims 1, 2, 5, 7 and 10 is respectfully requested.

7. Claims 1-5 stand rejected under 35 USC § 102(b) as being anticipated by Bradley (US 3,952,078).

It is submitted that claim 1, as amended, patentably distinguishes from Bradley. Nowhere does Bradley disclose the use of rotational agitation to shear thin a mixture. Bradley describes the use of vibration to generate pressure waves (Col.4, lines 26-32). As discussed above in relation to the Greenhalgh patent, pressure waves are not agitating means.

Bradley mentions mixtures of ammonium nitrate and ammonium sulfate as materials which may be prilled (Col. 4, lines 41-42). However, Bradley does not discuss reaction between the two, nor the necessity of providing time for reaction to occur in order to form a shear-thinnable mixture.

Thus, Bradley fails to teach each and every element set forth in amended claim 1, and thus in claims 2 –5 which directly depend from claim 1. Accordingly, reconsideration of the foregoing rejection of claims 1-5 is respectfully requested.

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8. Claims 1, 2, 3, 6, 7, and 8 stand rejected under 35 USC § 102(b) as being anticipated by Gelhaar (Swedish Patent No. 70119).

It is submitted that claims 1 and 7, as amended, patentably distinguish from Gelhaar. Gelhaar fails to disclose the step of reacting components at a temperature and for a time sufficient to form a shear-thinnable mixture. Gelhaar et al. discusses neither reaction of components, nor the formation of a shear-thinnable mixture. In Gelhaar, "...the mass as it melts is pressed out therefrom through a spray nozzle..." (claim 1, emphasis added). Thus in Gelhaar, no time is provided for reaction of ammonium nitrate with ammonium sulfate and the formation of a shear-thinnable mixture. The melt is ejected as it forms.

Moreover, Gelhaar fails to provide mechanical agitation of a shear-thinnable mixture in a prill head. The screw element C in Gelhaar conveys solid material through the heated tube. Once formed, the melt drops below the screw and is almost immediately ejected. Since there is no formation of a shear-thinnable mixture, there can be no agitation of a shear-thinnable mixture. The screw in any case does not extend into the area where the melt would momentarily reside.

Thus, Gelhaar fails to teach each and every element set forth in amended claims 1 and 7, and thus claims 2, 3, 6 and 8 which directly depend either from claim 1 or claim 7. Accordingly, reconsideration of the foregoing rejection of claims 1, 2, 3, 6, 7, and 8 is respectfully requested.

9. Claims 3, 4, 8 and 9 stand rejected under 35 USC § 103(a) as being unpatentable over De Bruyne et al. (US 3,055,049) as applied to claims 1 and 7, respectively in view of Brown Jr. et al (US 3,317,276) and Bradley (US 3,962,078).

To establish *prima facie* obviousness of a claimed invention, all claim limitations must be taught, or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). All the words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494,496 (CCPA 1970).

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Claims 3, 4, 8 and 9, dependent from claims 1 or 7 include the same limitations as the parent claims. It is submitted that the combination of De Bruyne et al., Brown Jr. and Bradley fail to teach or suggest all of the limitations in either claim 1 or claim 7, as amended. Specifically, nowhere in any of the references is there disclosure or suggestion of reaction of components to form a shear-thinnable mixture. Nowhere in any of the references is there disclosure or suggestion of mechanical agitation at a speed of at least 200 rpm to shear thin a shear-thinnable mixture.

Thus, the combination of De Bruyne et al., Brown Jr. and Bradley fails to teach each and every limitation set forth in amended claims 1 and 7, and claims 3, 4, 8 and 9 which directly depend either from claim 1 or claim 7. Accordingly, reconsideration of the foregoing rejection of claims 3, 4, 8 and 9 is respectfully requested.

10. In view of the foregoing amendments and remarks, it is submitted that the claims now of record, i.e., claims 1-10, as amended, and new claims 14-17, are allowable and should be passed to issue. Applicants respectfully request the same. The Examiner is invited to call the undersigned attorney if there are any unresolved issues to discuss same.

Respectfully submitted,  
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I hereby certify that this correspondence is being deposited with the United States Patent & Trademark Office via facsimile to Examiner R. Madsen, Group Art Unit 1761, at RightFax No. 703-872-9310 on March 27, 2002.

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Version with markings to show changes madeIn the specificationP.4, the paragraph beginning at line 35

~~The present invention is a prilling method comprising the steps of: providing a molten first component, mixing at least a second component with the molten first component, reacting the mixture to form a shear-thinnable mixture; and prilling the shear-thinnable mixture wherein the prilling comprises mechanically agitating in the prill head to shear thin the shear-thinnable mixture sufficiently to permit prilling.~~

The present invention is a prilling method to prill a shear-thinnable mixture comprising the steps of: providing a molten first component; mixing at least a second component with the molten first component; reacting the components at a temperature and for a time sufficient to form a shear-thinnable mixture; mechanically agitating the shear-thinnable mixture at a rate of at least 200 revolutions per minute in a prill head to shear thin the shear-thinnable mixture; and permitting the shear-thinned mixture to flow through holes in the prill head under the influence of a force selected from the group consisting of static pressure and centrifugal force. This method can be readily and inexpensively adapted to existing prill towers. In addition, the method allows for adequate mixing and reaction of the ingredients so that resultant beneficial properties can be exploited.

In the claims

1. (Amended) A prilling method to prill a shear-thinnable mixture comprising the steps of:
  - a) providing a molten first component;
  - b) mixing at least a second component with said molten first component;
  - c) reacting said components at a temperature and for a time sufficient to form a shear-thinnable mixture; and
  - d) prilling said shear-thinnable mixture wherein said prilling comprises mechanically agitating in the prill head to shear thin said shear-thinnable

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mixture sufficiently to permit prilling mechanically agitating said shear-thinnable mixture at a rate of at least 200 revolutions per minute in a prill head to shear thin said shear-thinnable mixture; and  
e) permitting said shear-thinned mixture to flow through holes in said prill head under the influence of a force selected from the group consisting of static pressure and centrifugal force.

7. (Amended) A prilling method to prill a shear-thinnable mixture through small prill holes comprising the steps of:

a) providing a molten first component;  
b) mixing at least a second component with said molten first component;  
c) reacting said components at a temperature and for a time sufficient to form a shear-thinnable mixture; and  
d) prilling said shear-thinnable mixture wherein said prilling comprises mechanically agitating in the prill head to shear thin said shear-thinnable mixture sufficiently and providing surface wiping blades to permit prilling mechanically agitating said shear-thinnable mixture at a rotational speed of at least 200 revolutions per minute in a prill head to shear thin said shear-thinnable mixture;  
e) wiping the surface of said prill head with surface wiping blades; and  
f) permitting said shear-thinned mixture to flow through small holes in said prill head under the influence of a force selected from the group consisting of static pressure and centrifugal force.

14. The prilling method according to claims 1 and 7, wherein essentially the entire liquid volume in said prill head is swept by an agitator.
15. The prilling method according to claims 3 and 8, wherein the reaction time is about 10 minutes to about 15 minutes.
16. The prilling method according to claims 3 and 8, wherein the reaction temperature is at least about 180°C to about 200°C.
17. The prilling method according to claims 3 and 8, wherein the ammonium nitrate and the ammonium sulfate are present in equimolar amounts.